NAS-IR-41024201
September 14, 1988
Revision A

U.S. Department of Transportation

Federal Aviation Administration

Interface Requirements Document

Voice Switching and Control System to Radio Control Equipment

(VSCS/RCE)

INTERFACE REQUIREMENTS DOCUMENT

APPROVAL SIGNATURE PAGE

Voice Switching and Control System (VSCS)/
Radio Control Equipment (RCE)

APPROVAL SIGNATURES		
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REVISION RECORD

REVISION LETTER	DESCRIPTION	DATE	ENTERED BY
A	This IRD revision incorporates IR number 9998-001, approved by the SE CCB on Sept. 14, 1988. This interface revision supersedes the baselined IRD NAS-IR-41024201 dated July 30, 1987.	Oct. 28, 1988	R. Allen

EFFECTIVITY	
LOCATION	INTERFACE EFFECTIVITY DATE
Alaska ACF Albuquerque ACF Atlanta ACF Boston ACF Chicago ACF Cleveland ACF Denver ACF Fort Worth ACF Hawaii ACF Houston ACF Indianapolis ACF Jacksonville ACF Kansas City ACF Long Island ACF Los Angeles ACF Memphis ACF Miami ACF Minneapolis ACF New York ACF Oakland ACF Salt Lake City ACF Seattle ACF Washington ACF	(In each case, the effectivity date of the interface shall be the date of the Operational Readiness Demonstration of the VSCS.)

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TABLES

1. SCOPE

1.1 Scope. This Interface Requirements Document (IRD) provides the requirements for an interface between the Voice Switching and Control System (VSCS) and the Radio Control Equipment (RCE).

1.2 Subsystem/equipment item responsibility list.

SUBSYSTEM	COMMON NAME	RESPONSIBLE PROGRAM OFFICE
Voice Switching and Control System	VSCS	AAP-400
Radio Control Equipment	RCE	APS-520

2. APPLICABLE DOCUMENTS

2.1 Government documents. Unless otherwise specified, the following documents of the issue in effect on the date of this IRD form a part of this IRD to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this IRD, this IRD shall be considered the superseding requirement.

SPECIFICATIONS:

Federal Aviation Administration (FAA)

FAA-G-2100	Electronic Equipment, General Requirements
FAA-STD-020	Transient Protection, Grounding, Bonding, and Shielding Requirements for Equipment

STANDARDS:

FED-STD-1003	Synchronous Bit-Oriented Data Link Control Procedures (Advanced Data Communications Control Procedures)

Federal

FED-STD-1020	Electrical Characteristics Of Balanced Voltage Digital Interface Circuits

OTHER PUBLICATIONS:

National Bureau of Standards (NBS)

FIPS PUB 1-2	Code For Information Interchange, Its Representations, Subsets, and Extensions.

Copies of specifications, standards, drawings, and publications required by suppliers in connection with specified procurement functions should be obtained from the procuring activity or as directed by the contracting officer.

2.2 Non-Government documents. Unless otherwise specified, the following documents of the issue in effect on the date of this IRD form a part of this IRD to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this IRD, this IRD shall be considered the superseding requirement.

Electronics Industries Association (EIA)

EIA-530	High Speed 25-Position Interface For Data Terminal Equipment and Data Circuit-Terminating Equipment

EIA-RS-422	Electrical Characteristics of Balanced Voltage Digital Interface Circuits

International Organization for Standardization (ISO)

ISO 2110	Data Communication - 25-pin DTE/DCE Interface Connector and Pin Assignments
ISO 7498	Information Processing Systems - Open Systems Interconnection - Basic Reference Model

Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and subscribing Federal agencies.

2.3 Related IRDs. Not applicable.

3. INTERFACE REQUIREMENTS

3.1 General requirements. The VSCS and the RCE shall exchange communications in order to support the following activities:

a. Communications between Area Control Facility (ACF) controllers or specialists and aircraft via air-ground (A/G) radio equipment.

b. Control by ACF controllers or specialists of both fixed-frequency and tuneable A/G radio equipment.

c. Provision of RCE configuration and status information to the VSCS.

In order to meet this requirement, VSCS and RCE shall exchange serial binary data, analog signals, and discrete control signals.

The total VSCS/RCE interface (see figure 1) shall consist of one VSCS/RCE configuration data link per facility, one VSCS/RCE audio interface for each A/G frequency to be controlled by the facility, and one VSCS/RCE frequency control interface for each A/G frequency to be controlled by the VSCS.

3.2 Functional requirements. Functional requirements for serial binary data exchange on the VSCS-RCE configuration data link are stated in terms of the Open Systems Interconnection (OSI) model described in ISO 7498. An OSI representation of the VSCS-RCE configuration data link (hereafter referred to as the "data link") is shown in Figure 2.

3.2.1 Application layer. Information exchange on the application layer of the data link interface shall consist of the exchange of messages as listed in paragraphs 3.2.1.2 through 3.2.1.7. Table 1 contains a list of the application messages. Figures 3 through 8 represent the VSCS/RCE message header and messages to be exchanged. There are four columns: Data Item Name, Data Type, Len Bytes, and Contents/Remarks. The Data Item Name column contains the name of fields found inside each message type. The Data Type column contains a descriptor of the type of data in the message fields. All data is in byte size fields in either ASCII character or unsigned binary integer format unless otherwise noted. The Len Bytes column is a measure of the length of the message fields in bytes. The Contents/Remarks column contains clarifying comments on the message fields.

Table 1. VSCS/RCE Messages

Message	IRD Paragraph
Frequency configuration report (RCE to VSCS)	3.2.1.2
Frequency configuration request (VSCS to RCE)	3.2.1.3
Module configuration report (RCE to VSCS)	3.2.1.5
Module configuration request (VSCS to RCE)	3.2.1.6
Error message report (VSCS to RCE)	3.2.1.7

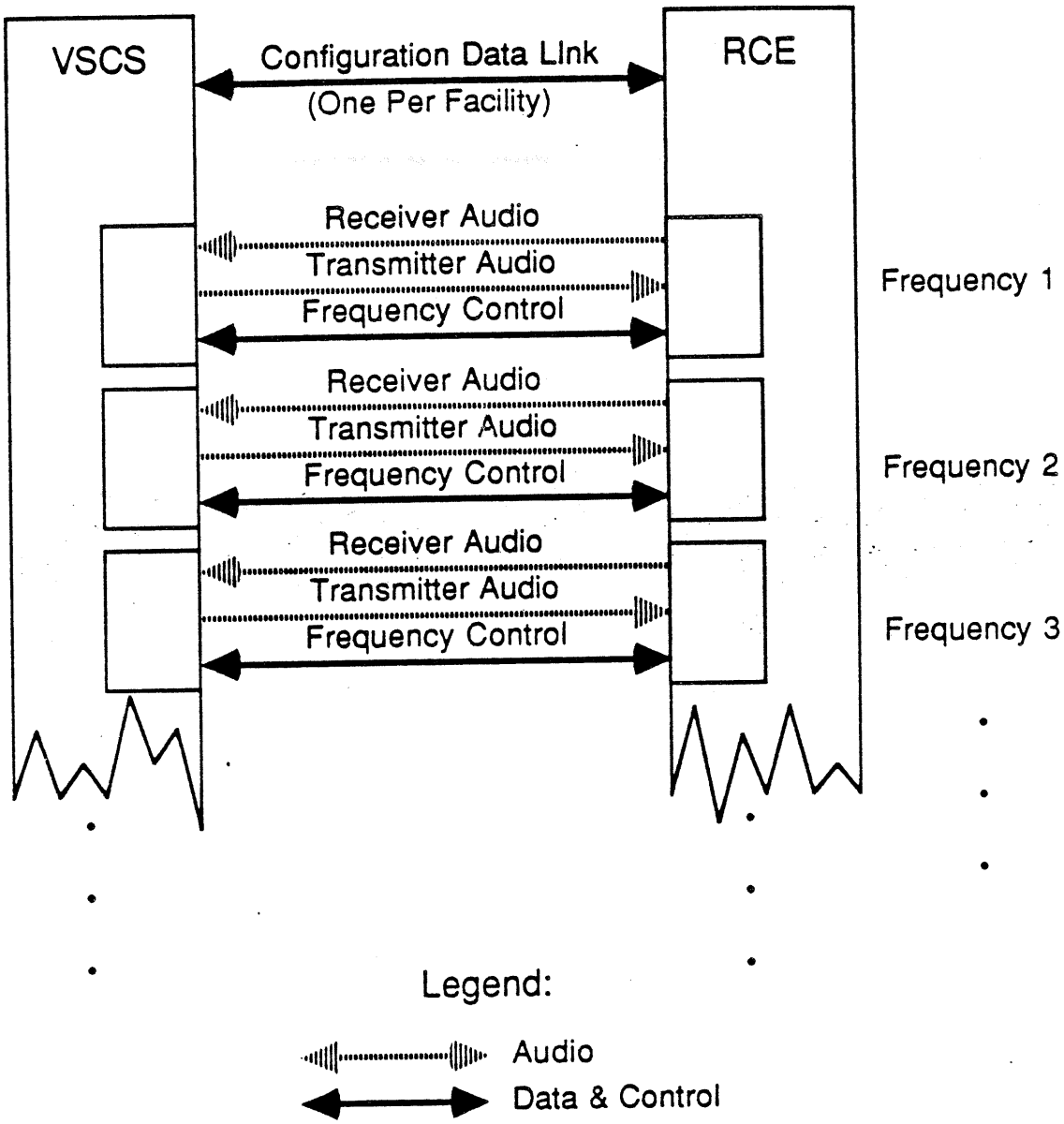
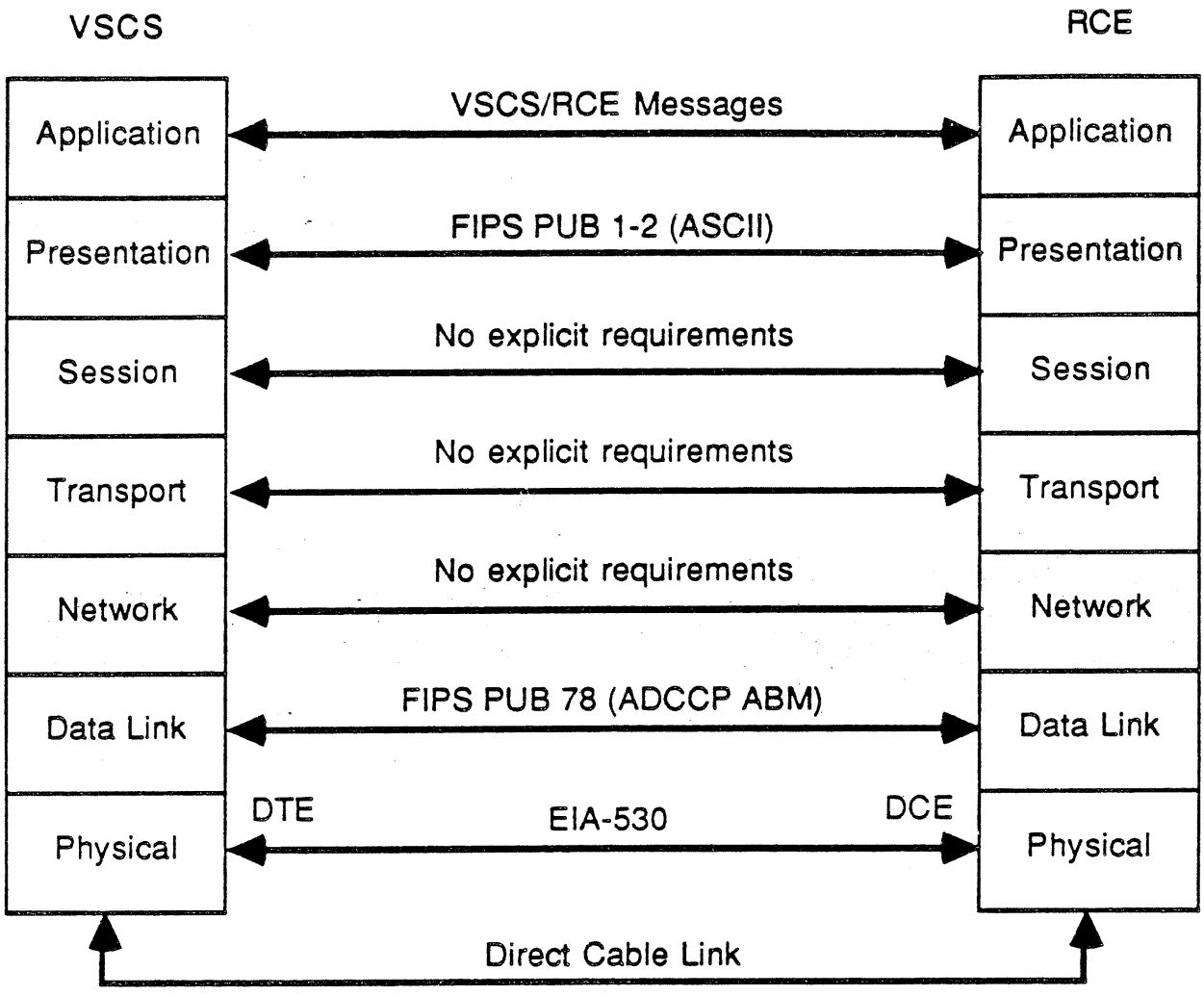


Figure 1 VSCS/RCE Interface



ABM	Asynchronous Balanced Mode (of ADCCP)
ADCCP	Advanced Data Communications Control Procedures
ASCII	American Standard Code for Information Interchange

Figure 2 VSCS/RCE Configuration Data Link Function Requirements

DATA ITEM NAME	DATA TYPE	LEN BYTES	CONTENTS / REMARKS
SOURCE ID	CHAR	2	UNIQUE IDENTIFIER
DESTINATION ID	CHAR	2	UNIQUE IDENTIFIER
MESSAGE LENGTH	INTEGER	2	LENGTH OF THE MESSAGE INCLUDING THIS HEADER
MESSAGE TYPE	INTEGER	1	
MESSAGE SUBTYPE	INTEGER	1	
DATA	INTEGER	VAR	ANY ONE OF THE DEFINED MESSAGES

FIGURE 3 Message Header

DATA ITEM NAME	DATA TYPE	LEN BYTES	CONTENTS / REMARKS
NUMBER OF MESSAGES IN REPORT	INTEGER	2	TOTAL NUMBER OF MESSAGES IN THE REPORT
REPORT SEQUENCE NUMBER	INTEGER	2	CURRENT MESSAGE SEQUENCE NUMBER
FREQUENCY ID	INTEGER	2	A FREQUENCY ASSOCIATED WITH A SITE.
FREQUENCY	INTEGER	3	FREQUENCY MEASURED IN KHz 119050-372000. CODED IN BCD
FREQUENCY MODE	INTEGER	1	0= SPLIT ELSE = THE NUMBER OF FREQUENCIES SELECTED
SELECT FREQUENCY ID	INTEGER	2	THE SELECT FREQUENCY ASSOCIATED WITH A SITE
TRUNK ID	INTEGER	2	IDENTIFICATION OF A TRUNK USED FOR THE FREQUENCY ID
FREQUENCY OVERIDE	INTEGER	1	0= OVERIDE IS NOT AVAILABLE 1= OVERIDE IS AVAILABLE
MAIN TRANSMITTER TYPE	INTEGER	1	0= TYPE UNKNOWN 1-255 = POSSIBLE TYPE IDs
MAIN TRANSMITTER SITE	CHAR	6	000000= NOT AVAILABLE ANY ASCII ALPHANUMERIC CHARACTER
MAIN TRANSMITTER STATUS	INTEGER	1	1=DOWN 2=OPERATIONAL
MAIN RECEIVER TYPE	INTEGER	1	0= TYPE UNKOWN 1-255 = POSSIBLE TYPE IDs
MAIN RECEIVER SITE	CHAR	6	000000= NOT AVAILABLE ANY ASCII ALPHANUMERIC CHARACTER
MAIN RECEIVER STATUS	INTEGER	1	1=DOWN 2=OPERATIONAL
STANDBY TRANSMITTER TYPE	INTEGER	1	0= SITE UNKOWN 1 - 255 = POSSIBLE TYPE IDs
STANDBY TRANSMITTER SITE	CHAR	6	000000= NOT AVAILABLE ANY ASCII ALPHANUMERIC CHARACTER
STANDBY TRANSMITTER STATUS	INTEGER	1	1=DOWN 2=OPERATIONAL
STANDBY RECEIVER TYPE	INTEGER	1	0= TYPE UNKOWN 1-255 = POSSIBLE TYPE IDs
STANDBY RECEIVER SITE	CHAR	6	000000= NOT AVAILABLE ANY ASCII ALPHANUMERIC CHARACTER
STANDBY RECEIVER STATUS	INTEGER	1	1=DOWN 2=OPERATIONAL
REMOTE MUTING CAPABILITY	INTEGER	1	0= NOT AVAILABLE 1= AVAILABLE

Figure 4 Frequency Configuration Report

DATA ITEM NAME	DATA TYPE	LEN BYTES	CONTENTS / REMARKS
NUMBER OF FREQUENCIES	INTEGER	2	NUMBER OF FREQUENCIES REQUESTED 0= ALL FREQUENCIES
FREQUENCY ID	INTEGER	2	ID OF THE FIRST FREQUENCY
...	...	...	...
FREQUENCY ID	INTEGER	2	ID OF THE Nth FREQUENCY

Figure 5 Frequency Configuration Request

DATA ITEM NAME	DATA TYPE	LEN BYTES	CONTENTS / REMARKS
NUMBER OF MODULES	INTEGER	2	TOTAL NUMBER OF MODULES IN MESSAGE
MODULE ID	INTEGER	2	ID OF THE MODULE ASSOCIATED WITH THE FREQUENCY ID
FREQUENCY ID	INTEGER	2	A FREQUENCY ASSOCIATED WITH A SITE

Figure 6 Module Configuration Report

DATA ITEM NAME	DATA TYPE	LEN BYTES	CONTENTS / REMARKS
NUMBER OF MODULES	INTEGER	2	NUMBER OF MODULES REQUESTED 0= ALL MODULES
MODULE ID	INTEGER	2	ID OF THE FIRST MODULE
...	...	...	...
MODULE ID	INTEGER	2	ID OF THE Nth MODULE

Figure 7 Module Configuration Request

DATA ITEM NAME	DATA TYPE	LEN BYTES	CONTENTS / REMARKS
VSCS MESSAGE	(1)	VAR	VSCS MESSAGE IN ERROR

Figure 8 Error Message Report

Note (1) Unspecified, as received, see text.

3.2.1.1 Message Header. The message header also called the applications header shall be used on all data link messages transmitted via the RCE/VSCS data link. See Figure 3 for an illustration of the message header. It shall have the following fields:

a. Source ID - This contains two characters which uniquely define the transmitting system.

b. Destination ID - This contains two characters which uniquely define the receiving system.

c. Message length - This field contains the length of the message transmitted in bytes including the message header field.

d. Message type - This field is used to identify the type of message being transmitted.

e. Message subtype - This field is used to identify the subtype of message being transmitted.

f. Message data - This field contains any one of the messages being transmitted.

3.2.1.2 Frequency configuration report. This report shall be sent both solicited and unsolicited by the RCE. When solicited by the VSCS it shall contain information requested by the Frequency Configuration Request message. The unsolicited report is sent when a configuration change occurs in the RCE. The unsolicited report shall contain only messages necessary to reflect changes in the RCE frequency configuration. Each "RCE Configuration Report" is transmitted in messages, with one message for every frequency configuration. See Figure 4 for an illustration of the Frequency Configuration Report message. The data fields shall contain the following information:

a. Number of messages in report - Contains the total number of messages being sent to the VSCS in the current report.

b. Report sequence number - This field acts as a counter which is incremented by 1 each time a message is sent. The minimum value is 1 and the maximum value is equal to the total number of messages in the report.

c. Frequency ID - Contains a unique value relating a frequency with a site. The corresponding frequency is contained in the "frequency" field and the site is contained in the "main transmitter site" field.

d. Frequency - Contains the frequency value in kHz.

e. Frequency mode - This indicates if this frequency ID is in frequency selective mode or split mote. If in split mode then the value is 0, else the value represents the number of selected frequencies. The number of the following "selective frequency ID" fields corresponds to the non 0 value.

f. Selective frequency IDs - The list of frequency IDs that are shared with the above frequency ID.

g. Trunk ID - The ID of the trunk used for the frequency ID field listed above.

h. Frequency override - A value of 0 is used when the override feature cannot be utilized and a value of 1 if it is used by the VSCS.

i. Main transmitter type - The type of main transmitter is identified by this field, including both standard transmitters and transceivers. A value of 0 indicates the type is unknown. When a transceiver is specified then the main receiver fields shall contain the same information.

j. Main transmitter site - The site of the main transmitter is identified by any alphanumeric character; all 000000's (zero's) indicate an unknown site ID.

k. Main transmitter status - The operational status of the transmitter with a value of 1 represents non-operational and a value or 2 represents normal operation.

l. Main receiver type, site and status - The same descriptions as given in main transmitter type, site and status except these are for the main receiver.

m. Standby transmitter type, site and status - The same descriptions as given in main transmitter type, site and status except these are for the standby transmitter.

n. Standby receiver type, site and status - The same descriptions as given in main transmitter type, site and status except these are for the standby receiver.

o. Remote muting capability - A value of 1 in this field means that remote muting is available, a value of 0 means it is not available.

3.2.1.3 Frequency configuration request. This request is transmitted to the RCE by the VSCS to request frequency configuration information. This message shall request information about specific frequencies or information on all frequencies. Each message transmitted shall not exceed 504 bytes of data including the applications header. The data field "frequency ID" listed below is repeated as many times as the "number of frequencies" field specifies. The Frequency configuration report message is illustrated in Figure 5.

a. Number of frequencies - A value of 0 in this field is a request for all frequencies. A non-zero value is a request for 1 or more frequencies as specified by this integer value. The number of "frequency ID" fields which follow will correspond to the number of frequencies being requested.

b. Frequency ID - This field is present when the "number of frequencies" field is not 0. It contains the frequency IDs for every frequency being requested.

3.2.1.4 Module configuration report. The module configuration report shall be transmitted both when solicited and unsolicited by the VSCS. When solicited by the VSCS this message will contain information requested by the Module Configuration Request message. An unsolicited message is sent when a configuration change occurs in the RCE. The unsolicited report shall contain only messages necessary to reflect the changes that have occurred in the RCE module configuration. Each message transmitted shall not exceed 504 bytes of data including the applications header. The Module configuration report message is illustrated in Figure 6. The two data field "Module ID" and "Frequency ID" listed below, are repeated as many times as the "number of modules" field specified.

a. Number of modules - This field contains the total number of modules contained in this message.

b. Module ID - This is an identification of an RCE IIB 1 module.

c. Frequency ID - This field contains the frequency ID to be transmitted via the Module identified by the Module ID.

3.2.1.5 Module configuration request. This message is transmitted by the VSCS to the RCE. Each message transmitted shall not exceed 504 bytes of data including the applications header. The two data fields "module ID" and "frequency ID" listed below are repeated as many times as the number of modules field specifies. The Module configuration request message is illustrated in Figure 7.

a. Number of modules - A value of 0 in this field is a request for all modules. A non-zero value is a request for 1 or more modules as specified by this integer value. The number of "module ID" fields which follow will correspond to the number of modules being requested.

b. Module ID - This field is present when the "number of modules" field is not 0. It contains the module IDs for every module for which information is being requested.

3.2.1.6 Error message report. The error message report is transmitted to the VSCS when the RCE detects a VSCS message that has been transmitted in error. The error message contains the VSCS message that was transmitted in error including its application header. The error message report is illustrated in Figure 8.

3.2.2 Presentation layer. Character data not already so encoded in accordance with the code and collating sequence described in FIPS PUB 1-2 (American Standard Code for Information Interchange). No further explicit presentation-layer requirements are imposed by this IRD.

3.2.3 Session layer. This IRD imposes no explicit session layer requirements.

3.2.4 Transport layer. This IRD imposes no explicit transport layer requirements.

3.2.5 Network layer. This IRD imposes no explicit network layer requirements.

3.2.6 Data link layer. The data link shall be in accordance with FED-STD-1003 (ADCCP). The asynchronous balanced mode (class B) shall be used, as described within FED-STD-1003.

3.2.7 Physical layer. The data link shall implement EIA RS-530. Data transfers will be carried out at 9600 bits per second. The VSCS shall be considered data terminal equipment (DTE), and the RCE shall be considered data circuit-terminating equipment (DCE). Pin configuration for the EIA RS-530 interface shall be as shown in Table II according to the definitions given in Table III. The local loopback (LL), remote loopback (RL), and test mode (TM) pins are not to be implemented.

3.2.8 Functional requirements for VSCS/RCE audio interface. The following VSCS and RCE audio signal exchanges are functional requirements for each A/G frequency to be controlled by the VSCS. These requirements are illustrated in Figure 9.

3.2.8.1 Receiver voice to VSCS. The RCE shall provide an audio connection to the VSCS to convey voice communications from remote A/G receiver equipment.

3.2.8.2 Transmitter voice to RCE. The VSCS shall provide an audio connection to the RCE to convey voice communications to be sent over A/G transmitter equipment.

3.2.9 Functional requirements for VSCS/RCE frequency control interface. The following control signal exchanges are functional requirements for each A/G frequency to be controlled by the VSCS. These requirements are illustrated schematically in Figure 10.

The terms "on state" and "off state" refer to the similarly-named signal states defined in FED-STD-1020 (RS-422).

3.2.9.1 Push-to-talk (PTT) control. The VSCS shall indicate the engagement of the push-to-talk control by putting the PTT signal in the on state. The PTT signal shall be maintained in the off state at all other times.

3.2.9.2 Receiver (RX) remote muting. The VSCS shall request the muting of a remote receiver by placing the RX muting signal in the on state. The signal shall be maintained in the off state at all other times.

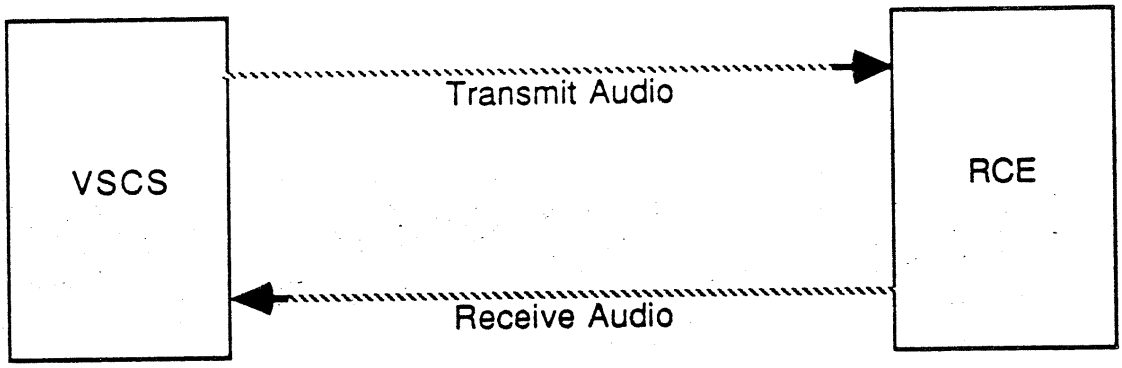


Figure 9 VSCS/RCE Audio Functional Requirements

3.2.9.3 Trunk lockout. The RCE shall indicate that a frequency is already in use by it primary site by placing the trunk lockout signal to the secondary site in the on state. The signal shall be maintained in the off state at all other times.

3.2.9.4 PTT confirmation. The RCE shall indicate that the PTT function has been engaged at the radio equipment by placing the PTT confirmation signal in the on state. The signal shall be maintained in the off state at all other times.

3.2.9.5 Main/standby transmitter (TX) selection. The VSCS shall request the RCE to switch from main to standby transmitters by changing the main/standby TX selection signal from the off state to the on state. The VSCS shall request the RCE to switch from standby to main transmitters by changing the main/standby TX selection signal from the on state to the off state.

3.2.9.6 Main/standby RX selection. The VSCS shall request the RCE to switch from main to standby receivers by changing the main/standby RX selection signal from the off state to the on state. The VSCS shall request the RCE to switch from standby to main receivers by changing the main/standby RX selection signal from the on state to the off state.

3.2.9.7 Main/standby TX confirmation. The RCE shall confirm to the VSCS the use of the main transmitter by placing the main/standby TX confirmation signal in the off state. The RCE shall confirm the use of the standby transmitter by placing the main/standby TX confirmation signal in the on state.

3.2.9.8 Main/standby RX confirmation. The RCE shall confirm to the VSCS the use of the main receiver by placing the main/standby RX confirmation signal in the off state. The RCE shall confirm the use of the standby receiver by placing the main/standby RX confirmation signal in the on state.

3.2.9.9 Squelch break. The RCE shall inform the VSCS that squelch has been broken on a receiver (i.e., that a signal has been presented to the receiver antenna) by placing the squelch break signal in the on state. The squelch break signal shall be maintained in the off state at all other times.

3.2.9.10 Receiver automatic gain control (AGC) voltage. The RCE shall supply to the VSCS an automatic gain control voltage corresponding to the receiver AGC.

3.2.9.11 RX remote muting confirmation. The RCE shall confirm to the VSCS that the remote receiver is muted by placing the RX remote muting signal in the on state. The signal shall be maintained in the off state at all other times.

3.2.10 Transceiver tuning. The VSCS/RCE interface shall not preclude the exchange of data needed to tune tunable transceivers.

3.3 Physical requirements.

3.3.1 Mechanical requirements.

Table II. Configuration Data Link Connector Pin Assignments

CONTACT NUMBER	CIRCUIT	INTERCHANGE POINTS	CIRCUIT CATEGORY	DIRECTION TO DCE	DIRECTION FROM DCE
1	Shield	-			
2	BA	A-A'	I	X	
3	BB	A-A'	I		X
4	CA	A-A'	I	X	
5	CB	A-A'	I		X
6	CC	A-A'	I		X
7	AB	C-C'	-		
8	CF	A-A'	I		X
9	DD	B-B'	I		X
10	CF	B-B'	I		X
11	DA	B-B'	I	X	
12	DB	B-B'	I		X
13	CB	B-B'	I		X
14	BA	B-B'	I	X	
15	DB	A-A'	I		X
16	BB	B-B'	I		X
17	DD	A-A'	I		X
18	LL	NOT IMPLEMENTED	II	X	
19	CA	B-B'	I	X	
20	CD	A-A'	I	X	
21	RL	NOT IMPLEMENTED	II	X	
22	CC	B-B'	I		X
23	CD	B-B'	I	X	
24	DA	A-A'	I	X	
25	TM	NOT IMPLEMENTED	II		X

NOTE: Interchange Points A-A', B-B' for each Category I circuit should be assigned twisted pairs in interconnecting cables to minimize cross-talk.

Table III. Definition of Interchange Circuits

CIRCUIT MNEMONIC	CIRCUIT NAME	CIRCUIT DIRECTION	CIRCUIT TYPE
AB	SIGNAL GROUND	-	-
BA	TRANSMITTED DATA	TO DCE	DATA
BB	RECEIVED DATA	FROM DCE	
DA	TRANSMIT SIGNAL ELEMENT TIMING (DTE SOURCE)	TO DCE	TIMING
DB	TRANSMIT SIGNAL ELEMENT TIMING (DCE SOURCE)	FROM DCE	
DD	RECEIVER SIGNAL ELEMENT TIMING (DCE SOURCE)	FROM DCE	
CA	REQUEST TO SEND	TO DCE	CONTROL
CB	CLEAR TO SEND	FROM DCE	
CF	RECEIVED LINE SIGNAL DETECTOR	FROM DCE	
CC	DCE READY	FROM DCE	
CD	DTE READY	TO DCE	
LL	NOT IMPLEMENTED		CONTROL
RL	NOT IMPLEMENTED		
TM	NOT IMPLEMENTED		

3.3.1.1 Installation.

3.3.1.1.1 Interchangeability. Interface equipment components that perform similar or identical functions shall be interchangeable.

3.3.1.1.2 Surface finish. Not applicable

3.3.1.1.3 Location and orientation. The location of the point of demarcation of the VSCS/RCE interface shall be a distribution frame within the facility in which the VSCS and the Type II RCE equipment is housed. The interface shall be oriented to allow unobstructed access for servicing.

3.3.1.1.4 Holes. Not applicable.

3.3.1.1.5 Fasteners. Fasteners shall be as specified in FAA-G-2100.

3.3.1.1.6 Bonding. Bonding shall be as specified in FAA-STD-020.

3.3.1.1.7 Weight and center of gravity (cg). Not applicable.

3.3.1.1.8 Materials. Materials shall be as specified in FAA-G-2100.

3.3.1.1.9 Markings. Markings shall be as specified in FAA-G-2100.

3.3.1.2 Connectors. The 25-pin connectors for the serial digital portion of the interface shall be in accordance with ISO-2110.

3.3.1.3 Fluids (gases and liquids). Not applicable.

3.3.1.4 Transportation and handling. Not applicable.

3.3.2 Electrical/electronic requirements.

3.3.2.1 VSCS/RCE configuration data link electronic requirements. The serial digital data interface between VSCS and RCE shall conform to the electronic requirements of EIA-530.

3.3.2.2 VSCS/RCE audio interface electronic characteristics.

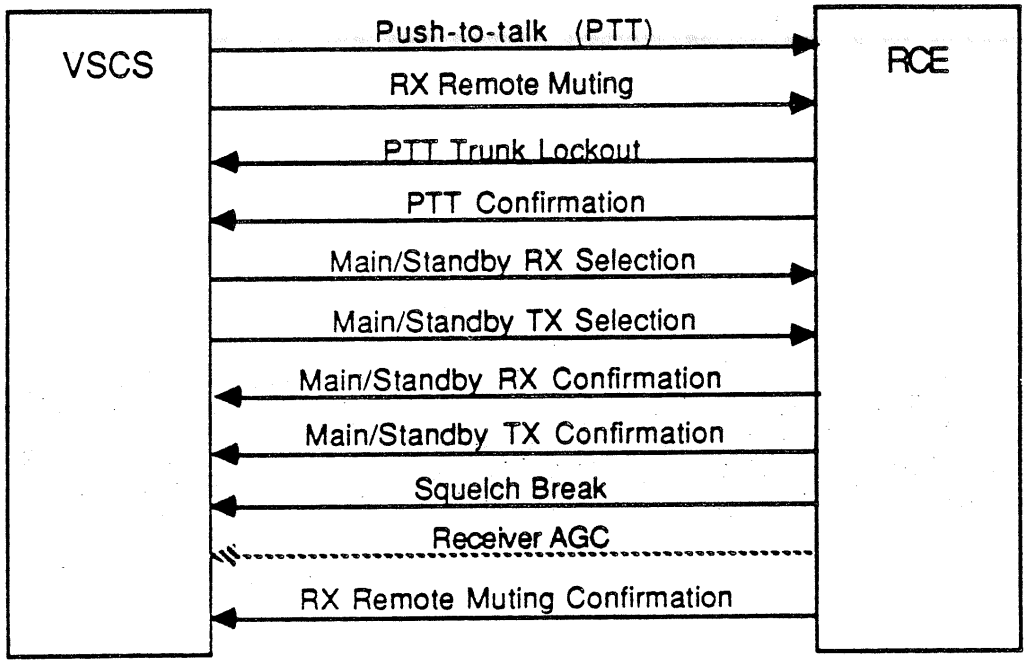
3.3.2.2.1 Receive audio electronic characteristics. The receiver audio signal from the RCE shall have the following characteristics:

Impedance: 600 Ohms $\pm$ 60 Ohms, transformer coupled.

Level: 0 dBm $\pm$ 1.5 dB nominal.

3.3.2.2.2 Transmit audio electronic characteristics. The transmit audio signal from the VSCS shall have the following characteristics:

Impedance: 600 Ohms $\pm$ 60 Ohms, transformer coupled.



Legend:

Differential control voltage
(per FED-STD-1020 (RS-422))

Automatic gain control voltage

Figure 10 VSCS/RCE Frequency Control Functional Requirements

Level: Average level during any three second period shall be between -5 and 0 dBm. The signal shall be regulated to maintain this output level for a voice input of ± 15 dB from the mean talker level of -13.9 dBm (as measured with a test tone inserted at the headset microphone jack at the VSCS console).

3.3.2.3 VSCS/RCE frequency control electronic requirements. Discrete control signals exchanged on the VSCS/RCE frequency control interface shall conform to the electrical characteristics detailed in FED-STD-1020 (RS-422), except as noted below.

3.3.2.3.1 AGC electrical characteristics. The AGC signal delivered to the VSCS shall be a direct-current (DC) voltage varying between 0 and +10 VDC in 0.1 V steps. The VSCS shall provide a minimum resistive load to this signal of 100K Ohms.

3.3.2.4 Electrical/electronic block diagrams. Electrical/electronic block diagrams are not used to impose requirements in this IRD.

3.3.2.5 System description. System descriptions are not used to impose requirements in this IRD.

3.3.2.6 Schematics. Schematics are not used to impose requirements in this IRD.

3.3.2.7 Interface wiring diagrams. Interface wiring diagrams are not used to impose requirements in this IRD.

3.3.2.8 Power capacity. This IRD imposes no explicit requirements pertaining to power capacity.

3.3.3 Environmental requirements.

3.3.3.1 Thermal requirements. This interface shall perform in accordance with the requirements specified herein throughout a temperature range of 10 to 50 degrees Celsius.

3.3.3.1.1 Passive heat transfer requirements. This IRD imposes no explicit passive heat transfer requirements.

3.3.3.1.2 Cooling. This IRD imposes no explicit cooling requirements.

3.3.3.2 Electromagnetic. Grounding and shielding for control of electromagnetic interference shall be in accordance with FAA-STD-020. Requirements for electromagnetic compatibility shall be as stated in FAA-G-2100.

3.3.3.3 Dynamic. Not applicable.

3.3.4 Envelope requirements. Not applicable.

4. QUALITY ASSURANCE PROVISIONS

4.1 General. Interface requirements imposed by section 3 of this IRD shall be verified by use of the verification methods specified in paragraph 4.4 and at the verification levels (phases) specified in paragraph 4.5. Verification methods and levels shall be applied in accordance with Table IV, Verification Requirements Traceability Matrix (VRTM).

4.2 Responsibility for verification. FAA Program Management shall be responsible for the verification of the interface requirements contained herein.

4.3 Special test support requirements. This IRD imposes no special test support requirements.

4.4 Verification methods and rationale. Methods of verification selected for use in this IRD are: Analysis (A), Test (T), Inspection (I), and Demonstration (D). Definitions of these verification methods are presented in section 6 of this IRD.

Selection of the verification methods used in this IRD was based on the following rationale:

Where practical, all requirements imposed by this IRD are verified by Test. Verification by Test provides a consistent measure of the fulfillment of technical interface requirements. Where Test is not practical, other methods of verification were evaluated and the method(s) which provided the most effective evaluation were chosen. In all cases, verification of each requirement is conducted at the lowest possible verification level.

4.5 Verification phases. At a minimum, one of the three levels of verification shall be performed to demonstrate that all interface requirements have been met. The three levels of verification are Subsystem, Integration, and Site. Definitions of the three verification levels are presented in section 6 of this IRD.

4.6 Quality conformance inspections. The VRTM presented in Table IV lists the requirements to be verified, the phase or levels at which verification will occur, and the methods of verification that will be used. Compliance with interface requirements will be evaluated in terms of the VRTM.

4.7 Verification requirements. There are no additional verification requirements imposed by this IRD.

Table IV Verification Requirements Traceability Matrix

D=Demonstration I=Inspection T=Test X=Not Applicable

Section 3 Requirements Paragraph Reference		Verification Phase and Method			
		Subsys Level	Integration Level	Site Level	Remarks
3	Interface requirements				TITLE
3.1	General requirements	I,D	I,D	I,D	
3.2	Functional requirements				DESCRIPTION
3.2.1	Application layer	D	D	X	
3.2.1.1	A/G frequency config table	I,D	D	X	
3.2.1.2	Report request messages	I,D	I,D	X	
3.2.1.3	Frequency configuration request	I,D	I,D	X	
3.2.1.4	Module configuration report	I,D	I,D	X	
3.2.1.5	Module configuration request	I,D	I,D	X	
3.2.1.6	Error message report	I,D	I,D	X	
3.2.2	Presentation layer				DESCRIPTION
3.2.3	Session layer	X	X	X	
3.2.4	Transport layer	X	X	X	
3.2.5	Network layer	X	X	X	
3.2.6	Data link layer	D	D	X	
3.2.7	Physical layer	T	T	X	
3.2.8	Functional Requirements for VSCS/RCE audio interface				DESCRIPTION
3.2.8.1	Receiver voice to VSCS	D	D	D	
3.2.8.2	Transmitter voice to VSCS	D	D	D	
3.2.9	Functional requirements for VSCS/RCE control interface				LEAD-IN
3.2.9.1	PTT control	D	D	X	
3.2.9.2	Receiver remote muting	D	D	X	
3.2.9.3	Trunk lockout	D	D	X	
3.2.9.4	PTT Confirmation	D	D	X	
3.2.9.5	Main/Standby transmitter selection	D	D	X	
3.2.9.6	Main/standby RX selection	D	D	X	
3.2.9.7	Main/standby TX confirmation	D	D	X	
3.2.9.8	Main/standby RX confirmation	D	D	X	
3.2.9.9	Squelch break	D	D	X	
3.2.9.10	RX automatic gain control	A	T	X	
3.2.9.11	RX remote muting confirmation	D	D	X	

Table IV Verification Requirements Traceability Matrix

D=Demonstration I=Inspection T=Test X=Not Applicable

Section 3 Requirements Paragraph Reference		Verification Phase and Method			
		Subsys Level	Integration Level	Site Level	Remarks
3.2.10	Transceiver tuning	D	D	X	
3.3	Physical requirements				TITLE
3.3.1	Mechanical requirements				TITLE
3.3.1.1	Installation				TITLE
3.3.1.1.1	Interchangeability	I	D	D	
3.3.1.1.2	Surface finish	I	X	X	
3.3.1.1.3	Location and orientation	X	X	I	
3.3.1.1.4	Holes	X	X	X	
3.3.1.1.5	Fasteners	I	X	X	
3.3.1.1.6	Bonding	T	X	X	
3.3.1.1.7	Weight and center of gravity	X	X	X	
3.3.1.1.8	Materials	T	X	X	
3.3.1.1.9	Markings	I	X	X	
3.3.1.2	Connectors	I	X	X	
3.3.1.3	Fluids (gases and liquids)	X	X	X	
3.3.1.4	Transportation and handling	X	X	X	
3.3.2	Electrical/electronic requirements				TITLE
3.3.2.1	Serial data interface electronic requirements	T	T	X	
3.3.2.2	Analog electronic characteristics				TITLE
3.3.2.2.1	Receive audio electronic characteristics	T	T	X	
3.3.2.2.2	Transmit audio electronic characteristics	T	T	X	
3.3.2.3	Control signal electronic	T	T	X	
3.3.2.3.1	AGC electrical characteristic	T	T	X	
3.3.2.4	Electrical/electronic block diagram	X	X	X	
3.3.2.5	System description	X	X	X	
3.3.2.6	Schematic	X	X	X	
3.3.2.7	Interface wiring diagrams	X	X	X	
3.3.2.8	Power capacity	X	X	X	
3.3.3	Environmental requirements				TITLE
3.3.3.1	Thermal requirements	T	X	X	

Table IV Verification Requirements Traceability Matrix

D=Demonstration I=Inspection T=Test X=Not Applicable

Section 3 Requirements Paragraph Reference		Verification Phase and Method			
		Subsys Level	Integration Level	Site Level	Remarks
3.3.3.1.1	Passive heat transfer requirement	X	X	X	
3.3.3.1.2	Cooling	X	X	X	
3.3.3.2	Electromagnetic	T	X	X	
3.3.3.3	Dynamic	X	X	X	
3.3.4	Envelopment requirements	X	X	X	

5. PREPARATION FOR DELIVERY

This section is not applicable to this IRD.

6. NOTES

6.1 Definitions.

6.1.1 Subsystem level verification. This level of verification is usually accomplished at the contractor's facility and culminates in the formal acceptance of the contractual end item.

6.1.2 NAS integration level verification. This level of verification is conducted at the FAA Technical Center or key site. The verification will determine if the hardware to be deployed for site installation will perform in a National Airspace System (NAS) environment and in accordance with NAS system level operational and functional requirements.

6.1.3 Site level verification. This level of verification is usually performed at the designated site. The verification portion of the subsystem installation and checkout will emphasize demonstration of the overall system performance requirements. It includes the demonstration of an end item, subsystem or system, final acceptance demonstrations, and commissioning activities.

6.1.4 Inspection. Inspection is a method of verification used to determine compliance without the use of special laboratory appliances, procedures, or services. Inspection consists of non-destructive static-state examination of the hardware, software, and/or the technical data documentation.

6.1.5 Test. Test is a method of verification wherein performance is measured during or after the controlled application of functional and/or environmental stimuli. Quantitative measurements are analyzed to determine the degree of compliance. The process uses laboratory equipment, procedures, and/or services.

6.1.6 Demonstration. Demonstration is a method of verification where qualitative determination of properties is made for an end item, including software and/or the use of technical data and documentation. The items being verified are observed, but not quantitatively measured in a dynamic state.

6.1.7 Analysis. This method of verification consists of comparing hardware of software design with known scientific and technical principles, procedures and practices to estimate the capability of the proposed design to meet the mission and system requirements.

6.2 Abbreviations and acronyms.

The following are acronyms and abbreviations used in this IRD.

A	Analysis
ACF	Area Control Facility
A/G	Air-ground

AGC	Automatic gain control
cg	Center of gravity
D	Demonstration
dB	Decibels
dBm	Power level in decibels referred to one milliwatt
DC	Direct current
EIA	Electronic Industries Association
FAA	Federal Aviation Administration
I	Inspection
IRD	Interface Requirements Document
ISO	International Organization for Standardization
NAS	National Airspace System
OSI	Open Systems Interconnection
PTT	Push-to-talk
RCE	Radio Control Equipment
RCF	Remote Communication Facility
RX	Receive (receiver)
T	Test
TX	Transmit (transmitter)
VRTM	Verification Requirements Traceability Matrix
VSCS	Voice Switching and Control System

6.3 Operational concept. This section provides non-binding information regarding certain issues associated with this interface.

6.3.1 Standby A/G communications function. The term "standby" as applied in this IRD to A/G transmitters and receivers denotes active or "hot" backup equipment; i.e., equipment maintained in fully-powered, ready-to-use condition. In case of failure of "main" equipment, the VSCS may switch to standby equipment. The intent of this note is to emphasize that this switching will take place within the Remote Communications Facility (RCF) where the receivers and transmitters are located. In other words, the main and standby equipments will both use the same audio and control trunk from the RCF back to the control facility.

6.3.2 Transceiver tuning. The information contained within this IRD regarding the operation of tuneable A/G transceiver equipment is not intended to be used as design guidance.

6.3.3 Air-to-ground communications string. The complete A/G communication string, of which this interface is a part, is illustrated in figure 11.

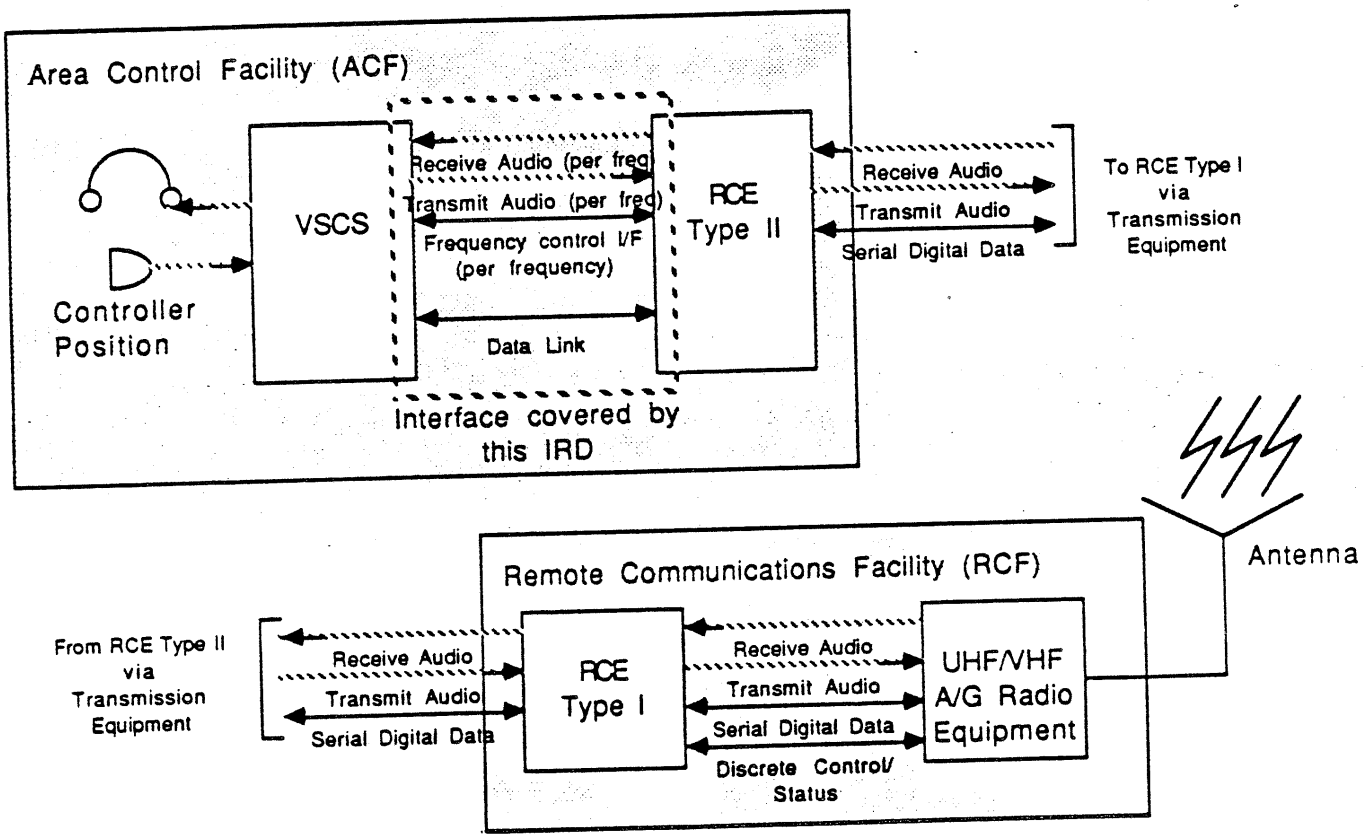


Figure 11. Air-Ground Communications Path